Factors Associated With H1N1 Influenza Vaccine Receipt in a High-Risk Population During the 2009-2010 H1N1 Influenza Pandemic

Sherri L. LaVela, PhD, MPH, MBA,[1-3] Barry Goldstein, MD, PhD,[2,4,5] Bella Etingen, MA,[1,2] Scott Miskevics, BS,[1] and Frances M. Weaver, PhD[1,2,6]

[1]Center for Management of Complex Chronic Care, Hines VA Hospital, Hines, Illinois; [2]Spinal Cord Injury Quality Enhancement Research Initiative, Department of Veterans Affairs, Hines, Illinois; [3]Institute for Healthcare Studies, Feinberg School of Medicine, Northwestern University, Chicago, Illinois; [4]Spinal Cord Injury and Disorders Strategic Healthcare Group, VA Puget Sound Health Care System, Seattle, Washington; [5]Department of Rehabilitation Medicine, University of Washington, Seattle, Washington; [6]Program in Health Services Research, Stritch School of Medicine, Loyola University, Maywood, Illinois

Background: Persons with spinal cord injuries and disorders (SCI/D) are at high risk for respiratory complications from influenza. During pandemic situations, where resources may be scarce, uncertainties may arise in veterans with SCI/D. **Objective:** To describe concerns, knowledge, and perceptions of information received during the 2009-2010 H1N1 influenza pandemic and to examine variables associated with H1N1 vaccine receipt. **Methods:** In August 2010, a cross-sectional survey was mailed to a national sample of veterans with traumatic and nontraumatic SCI/D. **Results:** During the pandemic, 58% of veterans with SCI/D received the H1N1 vaccine. Less than two-thirds of non-H1N1 vaccine recipients indicated intentions to get the next season's influenza vaccine. Being ≥50 years of age and depressed were significantly associated with higher odds of H1N1 vaccination. Being worried about vaccine side effects was associated with lower odds of H1N1 receipt. Compared to individuals who reported receiving an adequate amount of information about the pandemic, those who received too little information had significantly lower odds of receiving the H1N1 vaccine. Those who received accurate/clear information (vs confusing/conflicting) had 2 times greater odds of H1N1 vaccine receipt. **Conclusions:** H1N1 influenza vaccination was low in veterans with SCI/D. Of H1N1 vaccine nonrecipients, only 63% intend to get a seasonal vaccine next season. Providing an adequate amount of accurate and clear information is vital during uncertain times, as was demonstrated by the positive associations with H1N1 vaccination. Information-sharing efforts are needed, so that carry-over effects from the pandemic do not avert future healthy infection prevention behaviors. **Key words**: *H1N1 virus, infection control, influenza, pandemics, vaccination, veterans*

The swift spread of the 2009 novel H1N1 influenza virus prompted the World Health Organization (WHO) to declare a worldwide pandemic in early June 2009, indicating uncontained community-level transmission of the virus in multiple areas of the world.[1] The world experienced its first influenza pandemic in over 40 years. As H1N1 influenza quickly spread, it caused thousands of deaths and generated much confusion and panic. Due to the rapid spread of and uncertainties about the H1N1 virus, it is especially important to evaluate how individuals in high-risk groups experienced the H1N1 pandemic to prepare for future pandemics.

Persons with spinal cord injuries and disorders (SCI/D) are at extremely high risk for developing respiratory complications that can occur as a result of contracting influenza-like illnesses (ILI) due to their impaired respiratory function following injury.[2] During pandemic situations, where resources are often scarce, many uncertainties may arise in veterans with SCI/D. The objective of the current study was to describe concerns, knowledge, and information perceptions during the 2009-2010 H1N1 pandemic in a cohort of individuals with SCI/D and to examine variables independently associated with receipt of the H1N1 vaccine during the pandemic season.

Top Spinal Cord Inj Rehabil 2012;18(4):306–314

www.thomasland.com

doi: 10.1310/sci1804-306

Methods

This was a cross-sectional national mailed survey. The study was approved by the Institutional Review Board at Edward Hines Jr. Veterans Affairs (VA) Hospital. The sample included veterans with traumatic and nontraumatic SCI/D who received health care from one of 18 nationwide VA SCI Centers.

In August 2010, a cross-sectional survey was sent by mail to 9,761 veterans, along with a token incentive and a postage-paid business reply envelope for completed survey return. A follow-up survey was mailed within 4 weeks to veterans who did not respond.

Variables

Participant characteristics included demographics (age, gender, race/ethnicity, education, and living arrangement), *injury characteristics* (level: paraplegia vs tetraplegia, complete/incomplete, and duration of injury), and *health characteristics* during the prior year (general health status, hypertension, high cholesterol, diabetes, overweight/obese, heart conditions, lung/breathing conditions, depression, sleep problems, and pain).

A set of variables measured concerns, knowledge, and information related to H1N1. *Concern* variables assessed concerns about H1N1 influenza (very/somewhat; not very/not at all) and worries about H1N1 vaccine side effects during the 2009-2010 H1N1 pandemic (very/somewhat; not very/not at all). *Knowledge and information* variables assessed perceived knowledge about 2009-2010 H1N1 influenza (none, a little, a lot), amount of information provided about the H1N1 pandemic (not enough, adequate amount, too much), descriptions of information received regarding H1N1 (accurate, clear, confusing, conflicting), and satisfaction with ability to address flu-related concerns (very/mostly satisfied; mildly/quite dissatisfied). A few *general/seasonal influenza* items were also assessed; participants were asked if they had influenza this season (yes; no/not sure), received a seasonal vaccine during the pandemic season (yes/no), and if they planned to get an influenza vaccination during the next season (yes; no/not sure).

The main outcome measure, H1N1 vaccine receipt, was self-reported as a yes response to a question asking whether they received the H1N1 vaccine (yes/no) during the past several months (October 2009-June 2010). For analyses, the variable was dichotomized as "received the H1N1 vaccine" versus those who "did not receive H1N1 vaccine."

Statistical analyses

Bivariate analyses (chi-square tests for the categorical variables and *t* tests for continuous variables) were used to compare demographic, injury, and health characteristics; H1N1-related concerns, knowledge, and information; and general/seasonal influenza stance among persons with SCI/D by H1N1 vaccination status. A multivariate logistic regression model was used to generate odds ratios (ORs) and 95% confidence intervals (CIs) to identify variables independently associated with H1N1 vaccine receipt in veterans with SCI/D. Several variables (demographic, injury, and health characteristics and H1N1-related concerns/knowledge/information) were considered for inclusion in the model based on statistically significant bivariate associations and important associations as per literature. Collinearity was assessed for select variables (eg, age and duration of injury were highly collinear) for inclusion in the model. The model with the best fit according to the log likelihood ratio was used. Covariates in the final model included age, gender, living arrangement, general health status, hypertension, diabetes, lung conditions, depression, being worried about vaccine side effects, amount of H1N1 information received (not enough, adequate amount, too much), and information description (clear/accurate; confusing/conflicting). A subset analysis was conducted to check for differences in participant demographic, injury, and health characteristics between the sample used for analyses (n = 2,878) and those that were excluded from the model due to missing data (n = 506).

An alpha level of 0.05 was used to determine statistical significance. Statistical analyses were performed with SAS 9.2 (SAS Institute Inc., Cary, North Carolina).

Table 1. Participant characteristics by H1N1 vaccination status (n=3,384)

Characteristics	Received H1N1 vaccine (n=1,964) 58%	Did not receive H1N1 vaccine (n=1,420) 42%	*P*
Demographic characteristics			
Age (50 years and older) (n=3,201)	88.34	83.94	**.0003**
Male gender (n=3,298)	97.59	96.26	**.0272**
Race/ethnicity (n=3,237)			
White	72.63	73.28	.6836
Black/African American	15.02	14.42	.6363
Hispanic	8.77	8.13	.5193
All other: Asian, Native Hawaiian/Pacific Islander/ American Indian/Other	3.58	4.17	.3863
Education (n=3,305)			
< 12 years	7.02	5.87	.1851
12 years or equivalent	19.76	20.83	.4486
Some college	43.97	46.17	.2096
College graduate	29.25	27.13	.1825
Living arrangement (n=3,298)			
Formal care setting (with paid caregiver, nursing facility, group home/assisted living)	7.47	4.94	**.0034**
Live alone	24.40	26.22	.2334
Live with family/friend	68.14	68.84	.6688
Injury characteristics			
Level of injury (n=2,938)			
Paraplegia (incomplete)	36.77	36.50	.8817
Paraplegia (complete)	30.64	28.53	.2151
Tetraplegia (incomplete)	22.63	24.98	.1383
Tetraplegia (complete)	9.96	9.99	.9763
Mean duration of injury (range[a]; *SD*) (n=3,213)	21 (0-67; 16)	22 (0-67; 15)	.7065
Health characteristics/conditions[b]			
General health (n=3,299)			
Fair/poor	37.89	31.91	**.0004**
Good	36.58	35.95	.7069
Very good/excellent	25.53	32.14	**<.0001**
Hypertension (n=3,384)	41.65	37.61	**.0178**
High cholesterol (n=3,384)	28.41	27.46	.5451
Diabetes (n=3,384)	20.98	17.46	**.0109**
Overweight/obese (vs under/normal) (n=3,122)	66.63	63.92	.1147
Heart conditions/problems (cardiomyopathy, MI, heart failure, valve problems) (n=3,384)	11.51	9.72	.0974
Lung/breathing conditions (COPD, emphysema, asthma, chronic bronchitis, pneumonia) (n=3,384)	21.33	18.38	**.0343**
Depression (n=3,384)	30.14	25.85	**.0062**
Sleep problems (n=3,384)	42.31	40.07	.1914
Pain (n=3,384)	58.20	56.97	.4763

Note: MI = myocardial infarction; COPD = chronic obstructive pulmonary disease.

[a] For duration of injury, the lower value of zero for the range indicates less than 1 year (of 3,213 for which data were not missing; a total of 31 participants were injured for less than 1 year).

[b] Participants were asked about health conditions during the prior 12 months.

Results

Surveys were mailed to 9,761 veterans. The denominator was adjusted to 9,018, as 12 veterans had multiple sclerosis, 578 surveys were undeliverable, and 153 veterans on the initial mailing list had died. Completed surveys were available for 3,544 veterans (39% response rate), and 160 veterans with unknown H1N1 vaccination status were excluded (n = 3,384).

During the 2009-2010 H1N1 pandemic season, 58% of participants received the H1N1 influenza vaccination. **Table 1** shows comparisons of H1N1 vaccine receipt versus nonreceipt by demographic, injury, and health characteristics. A greater proportion of H1N1 vaccine recipients were 50 years of age or older (88.34%) compared with 83.94% of nonrecipients ($P = .0003$). A significantly greater proportion of males (97.59 vs 96.26%; $P = .0272$) received the H1N1 vaccine (vs did not receive H1N1 vaccine). A significantly greater proportion of individuals with SCI/D who lived in a formal care setting received H1N1 vaccine (7.47%) versus did not receive (4.94%) ($P = .0034$). There were no differences in H1N1 vaccine receipt versus nonreceipt by race/ethnicity, education level, injury level, or injury duration.

In terms of general health, overall 36% (data not shown) of veterans with SCI/D reported being in fair or poor health; significant differences in H1N1 influenza vaccination status were seen for those who reported fair/poor health (greater proportion received H1N1 vaccine) and very good/excellent health (lesser proportion received H1N1 vaccine), but no differences in vaccination status were seen for individuals who reported good general health. A significantly greater proportion of individuals with hypertension, diabetes, lung conditions, and depression received versus did not receive the H1N1 vaccine. H1N1 vaccination status did not significantly differ for individuals with high cholesterol, overweight/obesity, heart conditions, sleep problems, or pain.

Table 2 shows veterans' concerns about H1N1 influenza and vaccine side effects, knowledge of and information received (amount, clarity, satisfaction) with regard to the 2009-2010 H1N1 influenza pandemic. Greater proportions of individuals with SCI/D received H1N1 vaccination (vs non-vaccination) if they were somewhat/very concerned about H1N1 influenza during the pandemic (64.86% vs 39.97%; $P < .0001$), received adequate amount of information (80.12% vs 69.58%; $P < .0001$), described the information received regarding H1N1 as accurate/clear (72.02% vs 54.15%; $P < .0001$), and were satisfied with their ability to address influenza-related concerns (90.14% vs 85.80%; $P = .0002$). Individuals who felt they had "a little" knowledge about H1N1 influenza were more likely to be H1N1 vaccine recipients versus nonrecipients (68.43% vs 64.40%; $P = .0155$), but there were no differences in H1N1 vaccine receipt for those who reported "no knowledge" or "a lot of knowledge." Non-H1N1 vaccination (vs vaccination) was associated with being somewhat/very worried about H1N1 vaccine side effects (41.89% vs 25.87%; $P < .0001$), receiving "not enough" information (19.69% vs 13.68%; $P < .0001$) or "too much" information (10.72% vs 6.19%; $P < .0001$).

We also examined factors related to general/seasonal influenza (**Table 2**). Of those who received a seasonal influenza vaccine during the pandemic season, 97.96% also received H1N1 vaccine and 63.27% did not receive H1N1 vaccine ($P < .0001$). Further, less than two-thirds of non-H1N1 vaccine recipients indicated intentions to get an influenza vaccination during the next season.

Multivariate analyses were conducted on the sample with complete data for all variables (n = 2,878). Comparisons of the model sample and those excluded from the model due to missing data showed no statistically significances for age, gender, race/ethnicity, education, living arrangement, level of injury, or general health status. The model sample compared with those excluded due to missing data had a shorter mean duration of injury (21 years vs 23 years; $P = .02$) and greater proportions of persons with hypertension (41% vs 34%; $P = .004$) and lung/breathing conditions (21% vs 15%; $P = .003$), but there were no statistically significant differences in prevalence of any other chronic diseases.

Multivariate logistic regression findings (**Table 3**) indicated that being aged 50 years or older (OR, 1.33; 95% CI, 1.07-1.70) and having depression (OR, 1.29; 95% CI, 1.07-1.55) were significantly associated with higher odds of H1N1 vaccination. Compared with individuals who self-reported being in "good" health, the odds of receiving H1N1 vaccine were lower for those in "very good/excellent" health (OR, 0.80; 95% CI, 0.66-0.97). Male gender or having hypertension, diabetes, or lung/breathing conditions were not associated with H1N1 vaccination. Residence in a formal living arrangement (vs living alone or with family/friend) was marginally statistically associated with higher odds of H1N1 receipt.

Table 2. Concerns about, knowledge of, and information received regarding the 2009-2010 H1N1 influenza pandemic and general/seasonal influenza stance by H1N1 vaccination status (n=3,384)

	Received H1N1 vaccine (n=1,964) 58%	Did not receive H1N1 vaccine (n=1,420) 42%	*P*
Concerns			
Concerned about H1N1influenza during the pandemic (n=3,314)			**<.0001**
Very/somewhat	64.86	39.97	
Not very/not at all	35.14	60.03	
Level of worry about side effects from H1N1 influenza vaccine (n=3,304)			**<.0001**
Very/somewhat	25.87	41.89	
Not very/not at all worried	74.13	58.11	
Knowledge and information			
Perceived knowledge about 2009-2010 H1N1 influenza (n=3,295)			
No knowledge	10.21	12.20	.0717
A little knowledge	68.43	64.40	**.0155**
A lot of knowledge	21.36	23.39	.1660
Amount of information provided about the 2009-2010 H1N1 pandemic (n=3,293)			
Felt had adequate amount of information	80.12	69.58	**<.0001**
Felt had not enough information	13.68	19.69	**<.0001**
Felt had too much information	6.19	10.72	**<.0001**
Description of information received regarding H1N1 (n=3,157)			
Accurate/clear (vs. confusing/conflicting)	72.02	54.15	**<.0001**
Satisfaction level with ability to address influenza-related concerns (n=3,071)			
Very/mostly satisfied (vs mildly/quite dissatisfied)	90.14	85.80	**.0002**
General/seasonal influenza			
Did you have the flu this season? (n=3,315)			.3191
Yes	9.83	8.54	
No/not sure	90.17	91.46	
Received seasonal influenza vaccine during the pandemic season (n=3,369) (yes)	97.96	63.27	**<.0001**
Plan to get influenza vaccine next season (n=3,339)			**<.0001**
Yes	96.50	63.06	
No/not sure	3.50	36.94	

Being somewhat or very worried about H1N1 vaccine side effects was associated with lower odds of H1N1 receipt (OR, 0.50; 95% CI, 0.42-0.59). Compared to individuals who reported receiving an adequate amount of information about the 2009-2010 H1N1 influenza pandemic, those who received too little information were significantly less likely to have received the H1N1 vaccination (OR, 0.66; 95% CI, 0.50-0.89), but no significant differences in H1N1 vaccine receipt were observed for adequate versus too much information. Veterans with SCI/D who felt that the information they received about H1N1 influenza was accurate/clear had 2 times greater odds of receiving H1N1 vaccine (vs those who received confusing/conflicting information) (OR, 1.99; 95% CI, 1.67-2.37).

Discussion

Only 58% of veterans with SCI/D, a group at high-risk for respiratory complications, received H1N1 vaccination during the 2009-2010 H1N1 influenza pandemic. The seasonal influenza vaccination rate for this cohort was 83%. Further, veterans with SCI/D who received the seasonal vaccine during the 2009-2010 influenza season were significantly more likely to receive the H1N1

Table 3. Variables associated with H1N1 vaccine receipt in a high-risk population during the 2009-2010 H1N1 influenza pandemic (n= 2,878)

	OR (95% CI)	*P*
Age 50 years or older [49 years and younger]	1.33 (1.07-1.70)	**.011**
Male [female]	1.36 (0.87-2.11)	.175
Formal care living arrangement: with paid caregiver; in nursing facility; in group home/assisted living [live alone; live with family/friend]	1.39 (0.99-1.93)	**.055**
General health: Fair/poor [good]	1.16 (0.95-1.41)	.140
General health: Very good/excellent [good]	0.80 (0.66-0.97)	**.023**
Hypertension [no hypertension]	1.03 (0.87-1.22)	.714
Diabetes [no diabetes]	1.19 (0.97-1.47)	.097
Lung conditions [no lung conditions]	1.08 (0.88-1.32)	.482
Depression [no depression]	1.29 (1.07-1.55)	**.007**
Worried about vaccine side effects: very/somewhat [not too worried/not at all]	0.50 (0.42-0.59)	**<.0001**
Amount of information provided: Not enough [adequate]	0.66 (0.50-0.89)	**.006**
Amount of information provided: Too much [adequate]	0.89 (0.71-1.12)	.324
Information was accurate/clear [confusing/conflicting]	1.99 (1.67-2.37)	**<.0001**

vaccine, a finding that has been documented in other populations.[3,4]

Since 2005, the CDC has identified SCI/D as a high-risk condition for which seasonal influenza vaccination to prevent influenza is particularly important.[5] Specifically, the recommendations identified individuals with spinal cord injuries or other neuromuscular disorders that can compromise respiratory function or increase the risk for aspiration as individuals who should be vaccinated against influenza.[5,6] However, during the 2009-2010 season, the groups of individuals initially targeted for H1N1 vaccination differed. Priority groups for H1N1 vaccine initially focused on younger individuals, for example, those aged 25 to 64 years with medical conditions that put them at higher risk for influenza-related complications.[7] In fact, Vaux et al found that "being an individual at higher risk for influenza was not a determinant for pandemic influenza vaccine uptake. These determinants are not the same as those for seasonal influenza vaccination."[3]

As previously mentioned, older age was not initially prioritized for H1N1 vaccine, although the "typical" guidelines for seasonal influenza recommend vaccination for individuals aged 50 and older.[6,7] Yet, our findings showed that veterans with SCI/D who were aged 50 years or older had higher odds of H1N1 vaccination. In the wake of confusion about priority groups for H1N1 vaccination, it is encouraging that older individuals with SCI/D were still seeking H1N1 influenza vaccination.

Veterans with SCI/D who self-reported depression during the prior year had higher odds of H1N1 influenza vaccine receipt. Lord and colleagues identified several studies showing either no association or negative associations between depression and likelihood of vaccination receipt and concluded that older adults (50 years and older) suffering from depression have been found to be less likely to receive vaccinations.[8] In general, research has shown a decreased likelihood of engaging in preventive health behaviors, including influenza vaccination, among veterans with chronic conditions who have mental health conditions.[9]

Overall, over one-third (36%) of veterans with SCI/D reported being in fair or poor health. By comparison, 13% of the US adult population describe their health as fair or poor.[10] In the current study, of veterans with SCI/D in fair/poor health, a significantly greater proportion received H1N1 vaccination than did not receive vaccination during the pandemic. It is possible that due to their perceived fair/poor health status, these individuals believed they were at risk for (more susceptible to) influenza infection.

Another motivation for H1N1 vaccine receipt may be having high concerns that they/their family would be directly affected during an influenza pandemic; in fact, Jacobs et al found a high likelihood of this concern in adults with poor self-rated health.[11]

It is also possible that veterans' self-reported fair/poor health status was in line with their provider's assessment of their health and led to provider recommendation for H1N1 vaccination. Literature suggests that provider recommendation is highly associated with likelihood of influenza vaccination.[12] Maurer and colleagues found that during the H1N1 pandemic, adults who got a provider-issued vaccination recommendation were up to 32% more likely to receive influenza vaccination than those without a provider recommendation, after adjusting for confounders.[13]

In the current study, the odds for H1N1 vaccine receipt were lower when individuals were very/somewhat worried about side effects. In prior (nonpandemic) influenza seasons, previous studies identified concerns among veterans with SCI/D about vaccine side effects, mainly getting influenza or sick from the seasonal vaccine.[14-16] Although these concerns may not be unique to the H1N1 vaccine, they may weigh more heavily on decisions to be vaccinated during a pandemic. In a study of Canadian attitudes about the safety of the H1N1 vaccine, 41% thought it was unsafe and 35% were ambivalent over its safety.[17] Further, Liao and colleagues identified the key reasons given for not receiving H1N1 vaccine as perceived low risk from H1N1 (60%) and concerns about adverse side effects from the vaccine (37%).[18] Although the information disseminated in response to the 2009-2010 pandemic appears to have generated higher levels of concern about H1N1 than seasonal influenza, it did not reassure individuals of the safety and value of the pandemic vaccine.[19] Using the Protection Motivation Theory to study pandemic vaccination beliefs and behaviors, Bish et al suggest that these concerns about vaccination safety and side effects can be handled, in part, by reducing the omission bias (a perception that harm caused by action is worse than harm caused by inaction).[20]

The bivariate findings showed that significantly greater proportions of veterans with SCI/D who received "too little" and "too much" information did not get the H1N1 vaccine. Yet in the multivariate model, no significant differences in H1N1 vaccine receipt were observed for too much information (vs adequate), but those who reported receiving too little information had significantly fewer odds of H1N1 vaccine receipt. These data suggest that either too much or too little information may have a negative effect on desired behavior, but that too much is *better* than too little information with regard to pandemic influenza vaccination in this group at high risk for respiratory complications. Other research has shown that individuals who reported having received much/very much information about H1N1 influenza were significantly more likely to have engaged in one or more preventive behaviors (eg, hand washing, taking antiviral medication, staying home from work/school if experiencing symptoms) than those who reported receiving none/a little/some information (OR, 1.64, $P < .0001$).[21] In a study conducted in India, approximately 47% of participants reported believing they did not have enough information regarding H1N1[22]; this was much higher than the fewer than 20% of veterans with SCI/D who reported not enough information. These results suggest that communication efforts for this high-risk cohort were somewhat successful in conveying the right amount of information.

In addition, receiving accurate/clear information was positively associated with H1N1 vaccine receipt in veterans with SCI/D. The initial existence of 2 vaccines, seasonal and pandemic, created the potential for confusion and misinformation during the 2009-2010 influenza vaccination season.[13] The importance of providing clear information and reducing uncertainty has been discussed previously for various types of emergent health threats.[23] This uncertainty due to perceived unclear or exaggerated information about the pandemic has been found to decrease the likelihood of positive behavioral responses, such as hand washing and avoiding crowds to the incidents.[24] Across the globe[25] and among multiple cohorts (eg, pregnant women[26]), accounts of confusing and conflicting H1N1 information and

media messages concerning preventive behaviors for H1N1 have been reported. Convincing individuals to receive an influenza vaccination, especially during a pandemic when there can be so much uncertainty about both the vaccine and the illness, requires a well-planned communication approach. This approach should integrate into information that the population identifies as important, accurate, and clear.[27]

Finally, of those who did not receive H1N1 vaccine, only 63% indicated the intention to receive an influenza vaccination during the next influenza season. This is lower than the typical rates that are recorded for this population (VA performance data showed seasonal influenza receipt by 79% of veterans with SCI/D during the 2009-2010 season and 80% during the 2008-2009 season) and lower than the 76% vaccination target set for this population. To alleviate concerns and skepticism brought on by the 2009-2010 H1N1 influenza pandemic,[19] efforts are needed to share information with this high-risk population, so that carry-over effects from the pandemic do not avert healthy infection prevention behaviors in veterans with SCI/D.

These data are self-reported and are subject to recall bias. The response rate was low and may not be representative of the population of veterans with SCI/D.

Conclusion

The H1N1 influenza vaccination rate was low in the cohort of veterans with SCI/D (58%). Further, of H1N1 vaccine nonrecipients, only 63% indicated that they would get a seasonal influenza vaccination during the next influenza season.

We learned that the content and amount of information received is especially vital during uncertain times because these factors are associated with preventive behaviors. Our findings suggest that the provision of accurate and clear information, given in the appropriate amount, may empower individuals by making them feel knowledgeable and satisfied with the ability to address concerns (each of these factors was significantly independently associated with positive preventive behavior, H1N1 vaccination, in the current study). Our research contributes to the understanding of what is important in terms of information sharing during emergent issues such as the H1N1 pandemic, in special populations.

These findings provide a unique opportunity to prepare for the next pandemic threat, which has the potential to be more severe than the 2009-2010 H1N1 influenza pandemic. Information should be presented in a way that is consistent with our evolved social learning biases; these biases will influence both the message content and the appropriate amount of information to be delivered to different target populations.[27] Important for preparation is knowledge about veterans' response to such a threat, a key component of which is their perception/acceptability of information received. The results of this research should be extended to other emergent situations.

Acknowledgments

This material is based on work supported by the Office of Research and Development, Health Services Research and Development, and Spinal Cord Injury Quality Enhancement Research Initiative, of the Department of Veterans Affairs. This paper reflects only the authors' opinions and does not necessarily reflect the official position of the Department of Veterans Affairs. None of the authors have a financial or other relationship that might signify a conflict of interest.

REFERENCES

1. World Health Organization. WHO statistics. 2009. http://www.who.int/csr/disease/swineflu/en/index.html. Accessed November 18, 2009.
2. DeVivo MJ, Black KJ, Stover SL. Causes of death during the first 12 years after spinal cord injury. *Arch Phys Med Rehabil.* 1993;74(3):248-254.
3. Vaux S, van Cauteren D, Guthmann JP, et al. Influenza vaccination coverage against seasonal and pandemic influenza and their determinants in France: a cross-sectional survey. *BMC Public Health.* 2011;11(30).
4. Eastwood K, Durrheim DN, Jones A, Butler M. Acceptance of pandemic (H1N1) 2009 influenza by the Australian public. *Med J Aust.* 2010;192(1):33-36.
5. Advisory Committee on Immunization Practices. Prevention and control of influenza: recommendations

of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2005;54(RR-08):1-40.
6. Advisory Committee on Immunization Practices. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2009. *MMWR Recomm Rep*. 2009;58(RR-08):1-52.
7. Advisory Committee on Immunization Practices. Use of influenza A (H1N1) 2009 monovalent vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2009. *MMWR Recomm Rep*. 2009;58(RR-10):1-8.
8. Lord OL, Malone D, Mitchell AJ. Receipt of preventive care and medical screening for patients with mental illness: a comparative analysis. *Gen Hosp Psychiatry*. 2010;32:519-543.
9. Druss BG, Rosenheck RA, Desai MM, Perlin JB. Quality of preventive medical care for patients with mental disorders. *Med Care*. 2002;40(2):129-136.
10. Pleis JR, Lucas JW, Ward BW. Summary health statistics for U.S. adults: National Health Interview Survey, 2008. National Center for Health Statistics. *Vital Health Stat*. 2009;10(242):1-157.
11. Jacobs J, Taylor M, Agho K, Stevens G, Barr M, Raphael B. Factors associated with increased risk perception of pandemic influenza in Australia. *Influenza Res Treatment*. 2010;2010(1):1-7.
12. Vlahov D, Bond KT, Jones KC, Ompad DC. Factors associated with differential uptake of seasonal influenza immunizations among underserved communities during the 2009-2010 influenza season. *J Community Health*. 2012;37(2):282-287.
13. Maurer J, Harris KM. Contact and communication with healthcare providers regarding influenza vaccination during the 2009-2010 H1N1 pandemic. *Prev Med*. 2011;52(6):459-464.
14. LaVela SL, Smith B, Weaver FM. Perceived risk for influenza in veterans with spinal cord injuries and disorders. *Rehab Psych*. 2007;52(4):458-462.
15. LaVela SL, Cameron KA, Priebe M, Weaver FM. Development and testing of a vaccination message targeted to persons with spinal cord injuries and disorders. *J Spinal Cord Med*. 2008;31(1):44-52.
16. Weaver FM, Goldstein B, Evans CT, et al. Influenza vaccination among veterans with spinal cord injury: Part 2. Increasing vaccination rates. *J Spinal Cord Med*. 2003;26(3):210-218.
17. Seeman N, Ing A, Rizo C. Assessing and responding in real time to online anti-vaccine sentiment during a flu pandemic. *Healthc Q*. 2010;13(spec no):8-15.
18. Liao Q, Cowling BJ, Lam WW, Fielding R. Factors affecting intention to receive and self-reported receipt of 2009 pandemic (H1N1) vaccine in Hong Kong: a longitudinal study. *PLoS One*. 2011;6(3):e17713. doi:10.1371/journal.pone.0017713.
19. Maurer J, Uscher-Pines L, Harris KM. Perceived seriousness of seasonal and A(H1N1) influenzas, attitudes toward vaccination, and vaccine uptake among U.S. adults: Does the source of information matter? *Prev Med*. 2010;51(2):185-187.
20. Bish A, Yardley L, Nicoll A, Michie S. Factors associated with uptake of vaccination against pandemic influenza: a systematic review. *Vaccine*. 2011;29(38):6472-6484.
21. Bults M, Beaujean DJMA, de Zwart O, et al. Perceived risk, anxiety, and behavioural responses of the general public during the early phase of the Influenza A (H1N1) pandemic in the Netherlands: results of three consecutive online surveys. *BMC Public Health*. 2011;11(2). doi:10.1186/1471-2458-11-2.
22. Kamate SK, Agrawal A, Chaudhary H, Singh K, Mishra P, Asawa K. Public knowledge, attitude and behavioural changes in an Indian population during the Influenza A (H1N1) outbreak. *J Infect Dev Countries*. 2010;4(1):7-14.
23. Wray R, Becker SM, Henderson N, et al. Communicating with the public about emerging health threats: lessons from the pre-event message development project. *Am J Public Health*. 2008;98(12):2214-2222.
24. Rubin GJ, Amlot R, Page L, Wessely S. Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey. *BMJ*. 2009;339:b2651. doi: 10.1136/bmj.b2651.
25. Aburto NJ, Pevzner E, Lopez-Ridaura R, et al. Knowledge and adoption of community mitigation efforts in Mexico during the 2009 H1N1 pandemic. *Am J Prev Med*. 2010;39(5):395-402.
26. Sakaguchi S, Weitzner B, Carey N, et al. Pregnant women's perception of risk with use of the H1N1 vaccine. *J Obstet Gynaecol Can*. 2011;33(5):460-467.
27. Henrich NJ. Increasing pandemic vaccination rates with effective communication. *Hum Vaccin*. 2011;7(6):663-666.